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Readings from the Book of Nature

Phys 347.3

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READINGS

FROM THE

BOOK OF NATURE

BY

SIMEON MILLS

"Plants and trees are the children of light;
"Flowers and fruits are condensed sun beams."

CHICAGO:
CHARLES H. KERR & COMPANY,
1893.

F. 4824
Phys 347.3

HARVARD COLLEGE
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Madison,

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INTRODUCTION.

In reading the book of nature, some hidden truths have been discovered, some new theories formulated, and some speculative ideas indulged in.

The most important truth is the discovery that water is *the element*, and that hydrogen and oxygen gases, are *compound combustible substances*, and not the component parts of water.

The arguments and facts that *sustain* this great truth, it is hoped are so clearly stated, and the experiments that prove it, so well illustrated that it will not require a professional chemist to comprehend them.

The discoveries made and being made with electricity, will in all probability in the near future cause important changes in the natural sciences, as now understood and taught.

All that is desired is a careful investigation of the arguments and facts presented; and that secured the truths contained in the discoveries herein made known, will in the end prevail.

THE AUTHOR.

Madison, Wisconsin, 1893.

TO THE READER.

Reader, have you not often struck the prepared end of a common match against a rough surface, and seen a blaze instantly burst forth, and apparently consume the match?

Such, however, was not the case, the blaze did not burn the stick, it was the *result* and not the *cause* of its burning.

Have you not seen the seed fall upon the ground, and no matter which side or which end up it lay, burst its shell and always send its root downward and its top upward, grow and mature in the plant or tree?

Have you not sometimes been inclined to wonder how, or why, these things occur?

It is the purpose of these readings, to explain so far as possible, the cause of some of these little mysteries that surround us; illustrating each statement of fact, with such familiar examples that every reader can understand them.

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READING THE BOOK OF NATURE.

CHAPTER I.

STARTING OUT.

It has been the work of a lifetime, to discover and pick up a few things, that have always been before my eyes, and yet invisible.

To rake over old ashes that have been raked and sifted for centuries, with the expectation of finding pearls of great price, would seem to be a task not likely to return satisfactory results.

To learn from books, stores the mind with the wisdom of the past, but teaches us nothing that was not known before the books were made.

Learning solely from books, is to absorb possible errors, since authors sometimes commit the crime of being mistaken.

But to learn from nature, to study the lessons taught by her beautiful flowers, her fruits and plants and trees, is to gather wisdom and unwritten knowledge, from sources where no mistakes are found.

No new country could be discovered, but for the pioneer who fearlessly pushes out and erects his cabin in lands before unknown.

So in nature, to make any progress, any new discoveries, it is necessary to break loose from all established schools of learning and no longer think through books; to traverse unknown fields, spy out new paths, new channels of thought; to learn that which has not been written or taught; to glean and gather here and there a few glittering gems, guided only by the desire to learn from nature the true meaning of the many beautiful and wonderful things recorded on the pages of the book she spreads out before us.

And finally, starting out with a clear conviction, that in reading the book of nature, we should not skip the pages open at our feet, and around us, and waste our precious vision peering into the unknown and unknowable beyond.

Should I succeed in finding a single gem, or uttering a single thought, that shall lead to the discovery of but one hidden truth, science will be the gainer, knowledge will be advanced, and the world made wiser.

CHAPTER II.

AUTOMATIC MACHINERY.

Man invents and constructs mechanical contrivances, machines, and tools with which to carry on particular work, such as making other machines, and useful commodities necessary in the economy of life.

Some of these machines are called automatic, and when propelled by mechanical force, perform their work with regular and systematic certainty; notably the clock which counts and marks the divisions of time with a degree of accuracy that could not otherwise be attained.

In like manner the Creator of the Universe first devised and created *automatic machines* with which to commence and carry on the work of creating all things else that have been made.

These machines, science denominates forces of nature, and has given to each an appropriate name.

These forces or machines, unlike the automatic machinery made by man, do not require aid from any other source to give them motion. They are *self-propelling*, always at work bringing together the necessary elementary matter or raw material, assorting, moulding and cementing it into myriad forms, and in this way they bring into existence the multitude of objects that surround us.

When these created objects have run their course and served the purpose for which they were made, another automatic force or machine called *combustion*, which has been prepared for that purpose, makes its appearance, reverses the order of things, and instantly of its own self-acting power, proceeds to decompose, take apart and release from the cohesive grasp whatever had been so industriously joined together and built up by the creative forces; separating the elementary matter atom by atom, and assorting each kind by itself, fitted and prepared to be again used in the ceaseless round of creating and destroying, building up and pulling down, new forms of life and beauty.

It is the purpose of the following pages, to call

attention to, and investigate the action of some of these self-working machines, or *tools* of nature, which seem to have been heretofore somewhat overlooked or but partially understood.

The several little findings that have been picked up in the various readings and little voyages of discovery heretofore made, will be arranged and put together in the best order to pass the ordeal of public condemnation or approval.

In reading the book of nature, it will be in order to commence where nature did, at the beginning.

CHAPTER III.

MATTER.

Human intelligence has become conscious of the existence of matter in its present various forms and conditions.

All that can be known of its previous existence, and the endless changes that it has been constantly undergoing, must of necessity largely depend upon speculation, assumption, and theory.

It may be regarded then, as reasonable, to assume that matter has existed from "the beginning," and that it has been correctly defined, as "anything that occupies space, or takes up room."

The first condition in which matter could exist, must have been a primary or elementary condition, constituting the *raw material*, out of which everything has been created of which we can gain any knowledge, and supposed to consist of

ultimate atoms that cannot be divided or decomposed.

The most brief, if not the most perfect description of elementary matter to be found in any language, is this: "*The earth was without form, and void, and darkness was upon the face of the deep.*"

Elementary matter is thus described as a shapeless mass, as it existed before any *union* of different kinds of matter had taken place, so as to create new matter, or a new condition of matter.

It is sometimes very difficult to determine whether some things we are dealing with are material like air, or only sensation like sound; and the list of uncertainties, about which the most stubborn contentions have arisen, includes light, heat, electricity, magnetism, and the seven primary colors.

It is therefore important that some standard test should be discovered and adopted, that will at all times determine and settle this perplexing question with unerring certainty.

Such test is furnished by mechanics, and the law governing it is this:

If that which is in question, can be made subject to the action and control of any mechanical device or machine, it is MATERIAL; *but if machinery cannot act upon, or in any manner affect or control it, then it is less substantial than matter, and is only* SENSATION.

This standard will at all times make known that which is matter, with the same degree of certainty that the foot measures space, or the gallon determines capacity.

Thus it is found that machinery marks the dividing line between matter and sensation, so plain that it cannot be mistaken.

No objection urged against this law can be valid, until it is shown that in at least one instance machinery can be made to act upon and control that which is known to be only sensations, like mind, memory, reason, or judgment.

Elementary matter consists of two kinds, *ponderable* and *imponderable*, which will be considered in their proper order.

CHAPTER IV.

PONDERABLE AND IMPONDERABLE MATTER.

By ponderable matter is meant anything having weight, like air or iron, which can be accurately ascertained.

Up to the present time chemists have discovered and named upwards of sixty different kinds of elementary matter; but they say, "it is probable there may be other kinds not yet discovered, and equally probable that some kinds now regarded as elements, will be found to be compound substances."

All of the different kinds of elementary matter which chemists have discovered and named are *ponderable*, and the question of *imponderable* matter does not appear to have engaged the attention of scientists, further than to imagine the Universe filled with an imponderable ether, which cannot be weighed, or its presence in any other manner ascertained.

By imponderable matter is meant anything that occupies space, that can be stored up and preserved for future use, or that can be made subject to the action and control of any mechanical device or machine, and its presence thus made known; but upon which, if gravity acts at all, its influence is so very slight that its weight cannot be ascertained by any process yet known.

Science recognizes the existence of this kind of matter, by supposing the Universe filled with imponderable ether, the vibrations of which it is claimed cause light, heat, electricity, magnetism, and the seven primary colors, which are classed as *sensations* and not as *matter.*

As new discoveries have been made and knowledge advanced, it has been found and is now known, that all of these supposed sensations can be made subject to mechanical action and control, and thus coming within the law determining matter from sensation are found to be *material.*

If more evidence is required to prove their material character, it will be found in the fact that some of them are known to occupy space

and can be stored up for future use; and thus coming within the definition of matter given in text books of physics, as "anything that occupies space, or takes up room," are readily recognized as material.

It is not difficult to recognize the blaze of a candle or any other burning object, as matter; but if it has weight that fact cannot be ascertained.

The blaze of any burning substance, must therefore be regarded as imponderable matter, the flash of which, however, instantly disappears, passing off as light, heat, electricity and magnetism.

CHAPTER V.

ORGANIC MATTER.

It is an unchanging law of nature, that union of different kinds of elementary matter creates new matter.

By such union, the different kinds of matter lose their distinctive properties, and new matter, or a new kind or condition of matter, is created, called organic.*

The first account we have of the commencement of creation, by the union of different kinds of matter, is thus tersely given:

"God said let there be light, and there was light;" the seven primary colors are in this way described as coming together and uniting so as to create rays or beams of light, illuminating the universe.

* The word *organic* as used in this work, is given a technical meaning, broader and more comprehensive than is attached to it as used in physiology and botany, intended to include every condition of *compound* matter.

A familiar illustration of this union of different kinds of matter, will be found in elementary copper and zinc, which, being melted together, by uniting lose their distinctive properties as copper and zinc, and create a new kind of metal, called brass.

In this way we have two conditions of matter, elementary and organic, and matter cannot exist in any other form or condition.

There has been much time and labor expended in determining what is elementary, and what is organic matter; but the question does not appear to be any nearer a satisfactory solution at present, than it has been in the past.

It has therefore become necessary in determining this important question, that some *standard test* should be discovered and adopted, that will at all times determine with uniform certainty that which is *elementary* and that which is *organic* matter.

Such test will be found in combustion, and the law governing it is this:

Any substance that will not burn, or that cannot be decomposed by combustion, is elementary matter; and every substance that can be decom-

posed or changed in form or condition by combustion, is compound matter.

Elementary matter in compound bodies is held together by *cohesion*,—and compound bodies are dissolved into elementary matter, by *combustion.*

Wherever combustion takes place in the least possible degree there is decomposition, and elementary matter cannot be decomposed.

A fire cannot be made, a burning cannot take place, without proper fuel, and that cannot be supplied by elementary matter, because only compound substances are combustible; there is no elementary matter that will burn.

We then have this law *ordained by nature*, which points out with unerring certainty, that which is *elementary* and that which is *organic* matter.

The experiment of burning a combustible substance in a closed jar of oxygen, discloses the fact that a vacuum occurs in the jar, which shows that a loss of matter, or of something *occupying space*, has taken place; while the residuum that remains, showing no loss of weight, determines the fact that nothing ponderable has left the jar.

This phenomonon can only be satisfactorily explained upon the hypothesis that every combustible substance is composed of two kinds of matter, *ponderable* and *imponderable*, and that during the process of combustion, the imponderable matter being liberated, escapes from the jar, causing the vacuum, while the ponderable matter remains as residuum, preserving the weight.

Ponderable matter as before stated, includes the kinds that have been discovered and named by chemists; and imponderable matter consists of *light*, *heat*, *electricity*, *magnetism*, *and the seven primary colors* found in light.

CHAPTER VI.

ILLUSTRATING THE CREATION AND DECOMPOSITION OF ORGANIC MATTER.

The creation of organic bodies out of elementary matter, and their decomposition by combustion, can be very aptly illustrated in this way.

In a printing office, arranged in proper cases, are all of the letters of the alphabet, made of metal and called type.

These type letters are placed in separate boxes, each letter by itself, and for the purpose of illustration, may be supposed to represent *elementary* matter.

The man who handles or sets type, is called a *compositor*, and may be regarded as representing the automatic machines or creative forces of nature.

The compositor selects such *elementary letters* as are needed, and one by one unites them so that they lose their distinctive character as

letters, and create syllables, words and sentences, making a page of a book, which is *organic matter.*

This organic page also contains more than syllables, words, and sentences; there is within it another element of great importance, the impulse or sensation of thought and intelligence, which may be regarded as representing the imponderable matter contained in combustible substances.

When this organic page has served the purpose for which it was made, like animal and vegetable creations, it becomes dead matter, and goes into the hands of a man called the *distributor*, who represents *combustion.*

The distributor proceeds to *decompose* and destroy every syllable, word and sentence of the organic page, taking them apart letter by letter, and thus reducing it to elementary letters; in like manner as combustion *decomposes* and destroys a block of wood, taking it apart atom by atom, and reducing it to the elementary matter of which it was created.

The elementary letters thus separated and returned to their proper boxes by the distributor,

are again used in the composition of new syllables, words, and sentences; just as the elementary matter contained in the block of wood when liberated by combustion, goes into and becomes part of new plants and trees.

The impulse or sensation of thought and intelligence, contained in the organic page, is also liberated and disappears as the page is distributed; just as the imponderable light and heat contained in the block of wood, are liberated and disappear as the wood is decomposed by combustion.

The distributor does not act upon *elementary* letters, but upon *organic* words, restoring them to elementary letters; nor does combustion act upon *elementary* matter, but upon *organic* bodies, reducing them to elementary matter.

CHAPTER VII.

FORCE.

Science teaches us that force is that which acts upon matter, so as to change its form or condition; and that all visible changes in the universe result from the action of force upon matter.

This question naturally arises, in what way does force act upon matter, so as to change its form and condition?

In the last text book of physics published in Appleton's series in 1891, the learned author makes a broad distinction between force and energy, representing force as resulting from energy doing work, and then says (page 44,) "A force, it will be seen, can have no capacity to do work."

Unable to discover any sufficient reason for making this distinction, I shall use the words force, and energy, as synonymous, as shall seem

most proper and convenient, but always as meaning anything capable of changing the form or condition of matter.

Science also teaches us, "that force is as indestructible as matter, and that no greater amount of force exists in the universe at one time, than at some other time."

It seems evident then, that if force is self-existent, like matter, it cannot result from the conversion of something else into force; and it must be equally evident and follow as a matter of course, that one force cannot be changed or converted into some other force—like the "conversion of muscular force into heat force," as taught in text books—any more than one kind of matter can be changed or converted into some other kind of matter.

Everything that has an existence must have a distinctive existence of its own, and cannot exist as one thing to-day and to-morrow as something else. It may exist *in* something else, but not *as* something else.

One atom of matter cannot be changed to some other atom of matter; nor can one force which has a distinctive existence be changed to

some other force that did not before exist.

Two or more forces, like two or more kinds of matter, may unite to create a new force; but a force that has a distinctive created existence, cannot be annihilated by conversion into something else.

Nature stores up her forces in matter, in every conceivable form and condition in which matter is found to exist; so that every particle of matter becomes the store-house of some passive or dormant force.

Force is *active*, when it imparts motion to matter; it is *passive*, when stored up and lying dormant in matter.

Force does no work, except when it is active, for example: electricity when stored up and lying dormant in the battery, is as passive and harmless as the lamb; but when liberated, it becomes fiercer than the uncaged lion,—trundles street cars, and whirls electric engines.

Text books of physics, give this as the law governing force: "whenever any amount of force appears at one place an exactly equivalent amount of force disappears at some other place at the same time."

Is this law sound—is it in fact the law governing force? Let us see how it will stand the test of experiment.

An immense amount of force can be stored up and lie dormant and harmless in a barrel of gunpowder, but when the active force of a single spark is applied to it, the force thus stored up is instantly liberated, and makes its appearance millions of times greater than the amount of force that has disappeared by the extinguishment of the spark.

Force makes its *appearance* when it is liberated; it *disappears*, when it is stored up in matter.

It seems conclusive, then, that to make visible a great amount of force at one place, does not require the disappearance of an equivalent amount of force at some other place at the same time; but that this law is based upon false premises, is unsound, and should therefore be eliminated from text books.

When force that has been stored up and lying dormant in matter is liberated in one place, its effect becomes visible in changing the form or condition of matter in some other place.

Thus when the force is liberated from the cartridge placed in the gun, its effect becomes visible in the destructive work of the projectile thrown from the gun.

When force that has been stored up and lying dormant for ages, in the fuel placed under the boiler of the locomotive, is liberated, its effect becomes visible in the working engine, and moving cars.

The different forces are not stored up singly, but many or all existing forces are stored up at the same time in great abundance, in exceedingly small quantities of matter.

For example—from the food digested in the stomach, all of the forces are liberated that are necessary to sustain life, promote growth, and carry on the functions of the animal economy; while large amounts are stored up for future use in the muscles of the living body; and when liberated from the arm of the blacksmith, manifests itself in the blows that fall upon the heated iron, and in the sound waves which salute the ear.

The force that is liberated from the human hand when winding a watch, is stored up in the

spring of the watch; and as again liberated, its work becomes visible in the moving hands upon the dial.

The force expended by the hand in winding a watch, is not a conversion of muscular force into some other kind of force, but the same force that is liberated and leaves the hand, is transferred to, and is stored up in the spring, and is undoubtedly electricity.

Force being indestructible as matter, it must be *elementary* like matter, and no conversion of matter or motion into force can occur; and hence the only change that does or can take place, is the process of storing up and liberating forces that already exist.

In this way they so act upon matter as to change its form or condition.

Indeed, the learned author of the text book above quoted, seems at one time to have entertained some faint idea, some vague conception of this storing and liberating process of the forces, when he says (page 40) "we must remember then, that nothing but energy can be the cause of energy."

He does not, however, attempt to explain, or

in any manner illustrate his idea, by showing how one energy can be the cause of some other energy; but leaves the student in the dark, to work out the problem in his own way, as best he can.

I will illustrate my conception of energy being the cause of energy, in this way: the active energy of a single blow from a hammer, will liberate the dormant energy stored up in a few pounds of dynamite, sufficient to wreck the most substantial structure built by man.

It must not, however, be supposed that the energy of the blow from the hammer *caused* the great amount of energy that was evolved by the explosion of the dynamite, for that was not the case, it simply *caused* the liberation of forces already existing, and which had been accumulated in an immense amount, and stored up in a very small quantity of matter.

When thus liberated, the force stored up in the dynamite was free to act, and did not require aid from any other source or energy to give it motion, or cause it to act upon matter.

Energy does not act upon *energy*, it acts only upon *matter*, and cannot therefore be "the cause

of energy," except so far as to liberate the dormant energy stored up in the matter acted upon.

A dormant force can only be liberated by an *active* force, and when so liberated does not require the aid of some other force or energy to give it motion; but instantly, of its own impulse, proceeds to change the form or condition of matter.

This experiment seems to illustrate the author's idea, "that nothing but energy can be the cause of energy," so plain that even a freshman in physics can comprehend it.

Matter and *force* constitute the sum total of the universe; they act and react upon each other, and not upon any imaginary something else.

They come together and unite, by virtue of the great affinity they have for each other; and when force is being *stored up in matter*, elementary matter is taking on the form and condition of organic bodies; but when force is being *liberated from matter*, organic bodies are being restored to the condition of elementary matter.

In this way, force so acts upon matter, as to change its form and condition.

Force exists in two conditions, ACTIVE *when*

changing the form and condition of matter;
PASSIVE *when stored up and dormaut in matter.*

CHAPTER VIII.

DIVISION AND FORCES

The various forces of nature, constitute a well-arranged and perfectly organized system of self-propelling machinery, that carries on the work of creation, with constant and unceasing regularity.

These forces, which must of necessity have been co-existent with matter, are properly divisible into two classes, *mechanical* forces and *vital* forces.

Besides what come within these two classes, no force or automatic machine, having the capacity to cause any change in the form or condition of matter, has been found to exist.

The more thorough the investigation, the more certain it will appear, that nature, in her frugal economy, has not created two forces, with which to carry out the same plan, or accomplish the same work.

The mechanical forces, are intermittent, and at times appear to be somewhat irregular and erratic in character and action; but are nevertheless easily made subject to human control, are readily stored up in various forms and conditions of matter, made dormant or active at pleasure, and thus become obedient and useful servants of man, for economic and mechanical purposes.

This class of forces comprehends *light, heat, electricity, magnetism, and combustion.*

All of these forces are capable of being stored up in matter, and that some of them at least occupy space, although not yet known to have weight, is a fact so palpable to the common understanding, that it must eventually be recognized by science.

The vital forces are constant and unchanging, never varying in character and action, and no mechanical device, or invention of human skill or ingenuity, can increase or diminish the intensity of their action, or vary their course so much as the breadth of a hair.

This class includes *attraction, gravity, affinity, cohesion and repulsion.*

These forces are all stored up in matter, but none of them, with the exception of gravity, can be utilized for mechanical purposes; and that not by liberating it from the matter in which it is stored, as is the process in utilizing the mechanical forces, but by massing such matter so as to obtain the amount of pressure or weight, that will accomplish the work required. These two classes of force constitute the self-acting machinery of the universe, the entire *set of tools* used by the Creator, in carrying on the great work of creation from the beginning; and it is not reasonable to suppose that any material change will take place, in the systematic regularity with which they move forward in the work of making and unmaking the wonderful things that are constantly appearing and disappearing around us.

CHAPTER IX

MECHANICAL FORCES.

The mechanical forces as heretofore stated, are those natural forces that can be made subject to human action and control, and therefore must be regarded as material.

All motion arises from the movement of matter, and all mechanical force results therefrom.

Human conception cannot grasp or comprehend the existence of any mechanical force, that does not result from the action of matter.

We derive mechanical force from both kinds of matter, *ponderable and imponderable.*

We obtain mechanical power from ponderable fluids, by resisting the laws by which they are governed. Thus if we obstruct the natural flow of water, pile it up, or detain it by artificial means, from the active energy of each and every particle so obstructed, to again find its lowest

level, we derive a power useful for mechanical purposes, equal in extent to the magnitude of the obstruction interposed.

This is the process of utilizing ponderable fluids for economic purposes.

To obtain power from imponderable fluids, we pursue the same course, and reach the same result.

By damming up, accumulating, and obstructing the equalizing flow of heat and electricity, we cause a persistent and intense struggle of each and every individual atom of these fluids to gain its freedom and resume its normal condition, which gives power to the locomotive and the electric car.

When a quantity of *air* is compressed and driven into small space, and a volume of accumulated *electricity* is stored up in the battery, by cautiously manipulating and carefully handling the outflow of these two fluids, the same result follows; in both cases we obtain power, that turns the wheel, and applies brakes to the car.

It seems obvious, then, that all propulsive mechanical force can be summed up and stated in a few words; it results only from the action

of *matter* upon *matter* or, to state it more logically, where there is no matter, there can be no motion; and where there is no motion, there can be no force; hence, *without matter—without force.*

If you put your hands to the wheel-barrow and move it, it is matter acting upon matter; but if you sit down by it and direct all the energy of your sensations, your intelligence, your life, your soul towards it, the barrow will not move the breadth of a hair.

Is it probable, then, that sensations resulting from the vibrations of ether, can furnish power to move the locomotive or the electric car? On the contrary, is it not positive that there is no energy, no mechanical force or power, in or about the locomotive but the *heat* that has been liberated from the fuel placed under the boiler, and stored up in the steam? Sensation is vital, not material; its action is essential, not mechanical.

Thus it will be seen that, if the weight of the clock is held stationary, the hand upon its dial does not move; when the water is placid and the air serene, the wheel does not go round, the

mill does not grind, nor the spindle turn; and when the pent-up and circumscribed accumulations of heat and electricity become exhausted by their *diffusive outflow*, the locomotive is dead, the electric car is at a standstill, messages cease to fly, and the startling *hello!* no longer responds at the other end of the line.

Can any thinking man doubt that heat and electricity thus show themselves to be as much *material fluids* as the water and the air, and each as much a material force, as the stolid weight that gives life to the clock?

CHAPTER X.

VITAL FORCES.

The forces that have been enumerated in this class, are called vital, because they are essential, mysterious, living forces, that act upon matter with an irresistible regularity that cannot be reached, or in any manner varied or changed in form or degree, by human ingenuity or skill.

The action of, or the work performed by no two of these forces is identical, showing to a certainty that the Creator has not in the economy of creation, prepared useless machinery, or made two forces to carry on the same work.

The popular idea with regard to attraction and gravity seems to be that they are one and the same force and some learned authors speak of the planets as being "held in their orbits. by gravity."

This seems to be an inexcusable confounding of different forces, since no more resemblance

can be discovered, or connection found between the action of these two forces, than can be found between the action of any other two of the vital forces.

Attraction is a general force acting upon all matter, and causing all bodies of matter mutually to approach each other.

It is not limited in the intensity of its action by space, since the most distant planet is held as firmly in its orbit by the attraction of the sun, as the one nearest to it.

Attraction is completely *counteracted* by repulsion, so that when a comet is drawn towards the sun by its attraction, repulsion prevents their coming together, and sends it around the sun with such propulsive energy as to carry it far beyond the most distant planet.

The energy or force of attraction does not decrease as squares of distance increase, since comets which travel many times the distance of the outer planets of our system, are held so firmly by the attraction of the sun as to be again brought around in their orbits.

Attraction exerts its influence in all directions in which the attractive bodies chance to be located with regard to each other.

On the other hand, gravity is evidently a specific property of the earth, acting only upon objects *at or near* its surface.

It imparts to matter the peculiar property called weight.

Sir Isaac Newton, who discovered and first made known this force, demonstrated that the intensity of its action *decreased*, as squares of distance *increased*, so that at a comparatively short distance from the earth's surface, its action could no longer be felt.

Gravity acts in but one way, it draws every thing coming within its influence, in direct lines towards the center of the earth, and has no influence or effect whatever upon matter in any other direction.

The moon is held in its orbit by the attraction of the earth, but if it was within the reach of the earth's gravity, it would fall directly to its surface, like a ball thrown or shot in the air, or an aerolite when it comes within its influence.

Gravity is counteracted by velocity, while attraction is not affected by it.

Gravity is not in any manner affected by repulsion, for that has no power to retard or pre-

vent anything from falling directly to the surface of the earth.

When elementary matter has been brought together by attraction, affinity unites the different kinds in such manner as to create new matter; and in this way the objects that surround us have been created.

Gravity does not aid this work of creation, by bringing together particles of matter for that purpose, but its whole duty is discharged by drawing all created objects in direct lines toward the center of the earth, and holding them upon its surface.

Repulsion causes particles and bodies of matter to recede or move away from each other.

It counteracts both attraction and affinity, so that some things that are drawn towards each other by attraction do not come together and unite; but it does not in any manner affect the action of gravity.

There are several phases in the manifestation of attraction, such as the attraction of cohesion, the attraction of adhesion and so on, but there is but one phase or form of gravity, which never varies in its action upon matter.

Hence we do not say *cohesive* gravity, or *adhesive* gravity, but we speak of the gravity of the earth.

These two self-acting forces or machines evidently carry on the separate work assigned them by the Creator, who brought them into existence.

CHAPTER XI.

LIGHT.

Light evidently is not a simple elementary substance, but a compound or organized body created by the union of seven primary colors, which so unite as to lose their distinctive property as colors, and create a ray, or beam of light.

When a ray of light coming from the sun falls upon a mechanical device or machine called a prism, it is decomposed, and its different parts are as readily separated and ascertained, as the chemist can decompose and ascertain the composition of any substance he wishes to analyze.

Again, if these colors when separated by the prism, are so directed that they fall upon another mechanical device called a concave mirror, they will be reflected or sent back in the direction from which they came, and will again unite and become a ray of light.

From this decomposition of light into primary

colors, and their restoration again to light, we learn the process by which light is "stored up" in the formation and growth of all combustible substances.

When the rays of light fall upon and penetrate growing matter, the water which forms a very considerable portion of every living object, causes the same division of colors, in the growing matter that is revealed by the prism.

The colors thus separated, are absorbed and taken up in union with other matter, and thus create new matter, and new conditions of matter, composed largely of colors, which constitute a very essential part of every combustible substance; and can be seen in many objects found in the animal, vegetable and mineral kingdoms, displayed with all of the distinctive brilliancy and gorgeous hues that are found in the rainbow.

In this way colors are stored up, and mainly supply the imponderable matter found in every created object; and when liberated by combustion, like the rebounding colors from the concave mirror, they again unite and become light.

By utilizing the knowledge thus obtained of these wonderful processes of nature, we are

enabled to relieve the darkness of night, and in a limited way supply ourselves with the invigorating and life-giving influence of this most delicate and brilliant of all the natural forces.

That light is a mechanical force, becomes evident from the work it performs in the photographer's gallery, while its decomposition by the prism shows conclusively that it is subject to mechanical action and control, thus establishing the fact beyond reasonable doubt that it is *material*, and not sensation resulting from etherial vibrations.

CHAPTER XII.

HEAT.

Text books of physics describes heat as a "subtle fluid," so subtle indeed that it penetrates all things.

The law governing heat is the law of *diffusion*, by virtue of which every atom of heat seeks to equalize itself with every other atom of heat, in its immediate vicinity; so that, if any number of objects are brought into close proximity, differing as much in temperature as melted metals and blocks of ice, in obedience to this law of diffusion, radiation and absorption transfer the surplus heat of the one to supply the deficiency of the other, until every object is brought to the same degree of temperature; or so to speak, until heat, like water, finds its level.

A block of wood when immersed in water, and a bar of iron when exposed to heat, will

both expand and become enlarged in their external dimensions.

This expansion or enlargement of the block of wood, and the bar of iron, is due to the subtle action of the two fluids *heat* and *water*, which penetrate and enlarge the spatial intervals between the particles of matter of which the wood and the iron are composed.

As these spatial intervals are expanded and enlarged, they are at once filled with the matter of which fluids are composed, else a multitude of vacuums would occur. "Nature abhors a vacuum."

It will be found then, that the effect of the material fluids thus introduced into these enlarged cavities, is to prevent the coming together of the particles of the wood, and the iron, until the condition of each shall have been changed. When this occurs, the water by evaporation, and the heat by radiation, are withdrawn from the enlarged intervals, and the particles of wood and iron again come together, and the block and the bar resume their former size and condition.

Thus it will be seen that the expansion and

contraction in both cases, resulted from the introduction and withdrawal of *material fluids*, the one ponderable, adding weight to the wood, the other imponderable adding nothing in weight to the iron, but producing the same effect of *enlargement.*

Again, take these two fluids themselves, and see what results from their contact.

The subtle heat will enforce itself into and enlarge the spatial intervals between the particles of water, so that at 212° F. tenuity yields, and it passes off in vapor, more volatile than the atmosphere surrounding it.

Steam is as invisible as the atmosphere, but if a jet of steam be turned into an open jar, it will drive out the air and occupy the entire space within it; and if the jar be then closed, it will remain full until conditions change, and radiation of the heat takes place.

When the heat is reduced by radiation to 30° F. the jar will be found nearly a vacuum, the water contained in the steam will be changed to ice, occupying about one seventeen hundredth part of the space within it.

If the jar be opened with its mouth downwards

under water, it will instantly fill with water; thus showing conclusively that it had contained nothing that could occupy space within it, but the *water* and *heat* composing the steam.

The atoms of a cubic inch of water, occupy no more space when expanded to a cubic foot of steam, than they did as water.

The heat that divides, separates, and expands the atoms of water, occupies the remaining space within the cubic foot of steam.

It seems evident then beyond any reasonable doubt, that after the jar was filled with steam, a vacuum could not occur until *something* left the jar, that occupied space within it.

That something must be material, because the first definition of matter given in text books of physical science is this: "*Matter is anything that occupies space, takes up room.*"

In addition to the fact that heat can be made subject to mechanical action and control, we have the further evidence that it is material, that it occupies space, takes up room, and can also be stored up and retained for future use.

If the air pump be applied to a jar filled with air, and the contents be withdrawn, we know

that something that occupied the space within it has been removed.

If we apply the same reasoning to the jar that was filled with steam, we shall find that when the heat left it, something occupying space within it had gone, leaving a vacuum precisely the same as when the air was taken out with the pump.

Heat seems to be *life*—no living thing exists without it.

It may be that heat, electricity, and magnetism, impart *life*, *motion*, and *instinct* to living objects.

When heat departs from living things, death follows, and in its wake, combustion comes and restores the dead body to its first condition of elementary matter.

Heat is always in motion, never at a state of voluntary rest for the shortest moment of time; and yet under certain conditions, it can be handled and controlled—increased or diminished, at any given point, or stored up and liberated at pleasure, for immediate or future use.

There is no substance known, that is so dense or so substantial, that heat does not penetrate and change it.

Why then dwarf it to the condition of a mere sensation, a secondary force, resulting from *vibrations* a thousand times less subtle and powerful, than the *offspring* they produce.

CHAPTER XIII.

ELECTRICITY.

Electricity at the present time, seems to be an enigma in science—the wonder and admiration of the world.

The discoveries that are constantly being made regarding it, are likely in a very short time to cause material modifications in both chemistry and physics as now understood and taught.

Although many discoveries have been made, as yet but little is actually known concerning this mysterious agent, except that it is the most active and subtle of all mechanical forces. All else is necessarily, to a very great extent, matter of speculation and conjecture.

It is of the utmost importance, in investigating any substance or thing, not only to ascertain its nature and character, but the material of which it is composed.

When the chemist desires to ascertain the

component parts of any particular substance he has in hand, he at once proceeds to decompose and separate the different kinds of matter that make up its whole, and in this way is able to state with unerring certainty, every thing that was contained in the body decomposed.

Hence it has been possible to determine that the air we breathe is composed or made up of two gases, united in proper proportions; and in this way it becomes known that the air, as such, did not exist until created by the union of oxygen and nitrogen gases.

In like manner the scientist, by the application and use of a certain well-known mechanical contrivance, takes apart and decomposes a ray of light, and finds that it is created by the union of seven primary colors, and therefore determines with certainty that light does not exist as such, until created in this way.

By the skillful use of other means, it has become possible also to separate electricity into *light, heat and magnetism,* and it is found that it can be as readily decomposed or divided into these three component parts, as light can be separated into colors, or air into gases.

Hence we reason that electricity is not a simple elementary substance or force, like heat and magnetism, but that it has no existence as electricity until the intense mechanical energy of light, heat and magnetism unite in such proportions as to create this *grand propulsive force of the universe*, in like manner as primary colors unite to create light.

Having discovered this much, the next step in the investigation is to ascertain the nature of these component parts as revealed by this analysis.

The primary colors composing light, evidently thus become an important part of the electric force.

Heat is another kind of imponderable matter or elementary force that is *per se* life and motion. It not only puts itself in motion, but it imparts motion to every atom of matter, with which it comes in contact.

Heat must evidently be regarded as the *motor* of the universe, through the agency of which the *Creator* carries on the great work of creation, giving life and energy to matter, and mechanical motion and force, to electricity.

Magnetism is the *instinct*, the intelligence, which in like manner HE imparts to matter, and makes it manifest not only in the needle, as heretofore described, but also in every living object.

Hence it will be seen that we have *matter*, *motion*, *life*, *light*, *beauty*, and *instinct* combined in *electricity*, which constitutes the *sum total* of all that is found in the universe capable of imparting life, motion, and instinctive intelligence to created objects.

Electricity is the most active and powerful of any mechanical force yet discovered. It is the combination of all known mechanical energy, except gravity, and may include that also.

Mechanical force results from the motion of matter acting upon matter, and from no other source whatever can any force be obtained that will move the weight of a feather.

It is the flow of water that falls upon the wheel that turns it; this is matter acting upon matter.

In like manner it is the flow of the electric fluid that rushes upon the well-devised and properly-constructed machinery, that moves the

car. This must also be matter acting upon matter.

In these two applications of force, we see clearly illustrated the great difference between that derived from *ponderable* and *imponderable matter*.

The former, simply by its dead weight or gravity, is constantly pulling in one direction, drawing everything downward in direct lines toward the center of the earth, and utterly incapable of exerting any influence in any other direction whatever.

The action and movement of imponderable matter is essentially different. Heat being always in motion when not obstructed, is undoubtedly the *initiatve or unit* of all mechanical force derived from this class of matter.

Neither heat nor electricity requires aid from any source, but moves at will, carrying matter in *all* directions, with the same energetic persistency that gravity moves everything ponderable in *one* direction, downward.

The mechanical force of each must result from the same cause, the action of matter upon matter.

Gravity sluggishly carries the water downward, striking the wheel at a velocity of about sixteen feet in a second, while electricity when liberated rushes in any and all directions dashing against the machinery, obstructing its passage, with the fearful velocity of more than 180,000 miles in the same period of time; while in both cases the mechanical force results from the same cause, the action of matter upon matter.

If a wedge be driven into a block of wood, it overcomes the cohesive resistance, and rives the block assunder.

Who has not seen the lightning's flash, or the current of electric fluid in its wild rush from the storm cloud to the earth, encounter the giant of the forest, and instantly split it from top to root?

Can human intelligence conceive, or comprehend the existence of anything less substantial than matter, that can be driven into the wood of the standing oak, split it asunder, as the wedge cleft the block, and send its riven part to the earth in opposite directions?

There is an invisible unknown influence, that imparts *living* motion to matter; and it may be

that *electricity* is the hitherto undiscovered origin *of Life*, that gives intelligent action to created objects; coming and going unbidden, and when it takes its final departure, the *living body* becomes *dead matter*, the prey of combustion.

The revelations of electricity are yet in their infancy, and in the near future it may be found, that all mechanical, vital and mental energies, are but different manifestations of this subtle and mysterious fluid.

CHAPTER XIV.

MAGNETISM.

Magnetism imparts to certain conditions of matter, the property of *voluntary motion*, and the *impulse* of *instinct*, by virtue of which the magnetic needle seeks to place itself at right angles with the equator, and point in a north and south direction.

This magnetic instinct, manifests itself in many ways, and in every form and condition of living, growing objects.

If a magnet be drawn through a mixture of iron filings, sand, and other foreign susbtances, it will, guided by magnetic instincts, select, sort out, pick up, and carry along with it, such atoms and choice bits as it prefers, just as intelligence guides the human hand, in selecting seeds from chaff, or separating gold from dross.

It is this magnetic instinct, this intelligence of living matter, that causes the seed that falls

upon the ground to send its root downward, and its top upward, that it may grow and mature in the plant or tree, and bear seed in its turn to perpetuate its species.

It is this instinct imparted to matter by magnetism, that teaches the vine to twine around its support, always the same way, and no skill or ingenuity of the gardener, can change its course or persuade it to grow in the opposite direction.

It imparts to the grape-vine, the foresight to reach out its tendril arms, and twine its little fingers around the nearest object for support, just as human intelligence directs the outstretched hand to lay hold of any object in reach, to prevent an impending fall.

It is the instinctive intelligence of matter that teaches the sensitive plant, when touched, to fold itself up to avert impending harm, just as it teaches the worm to roll itself into compact form when disturbed by something it seeks to avoid.

It teaches the bee, that to construct the cell in which to store its food, with six equal sides, is the design best calculated to economize its limited space.

In like manner it teaches the young bird to construct its first nest, precisely like those built by its ancestors, for a thousand generations that have lived and died before its day.

It is the instinct imparted by magnetism, that teaches the young of living kind, to seek the natural food, necessary to sustain their new born life.

In short it teaches every living object found in the animal and vegetable kingdoms, to choose the most appropriate food to promote its growth and prosperity, and cling to methods best calculated to preserve and prolong its brief existence.

All this it does just as it imparts to the needle the instinctive knowledge, that to point in a north and south direction, it must not turn towards the rising or the setting sun.

This is the *instinctive intelligence* of magnetism, imparting its impulse to every particle of living matter, differing only in degree. As your whole structure is intelligent, so is each individual particle of matter composing it. There is not an atom of your body, so remote or so stupid, but that if it receives an injury it instantly communicates the intelligence to every

other atom composing your existence; because instinctive intelligence reaches every atom of all the parts, as well as the whole organic structure.

Again, where there is intelligence there must be life, for the sensation of instinct does not take up its abode nor manifest its presence in connection with dead matter.

The carrier pigeon, forcibly removed from the place it has been wont to inhabit, as soon as liberated, circles round and round until its proper direction is instinctively pointed out, when it instantly darts out in a direct line towards the place from whence it had been taken.

So with the magnetic needle; turn it out of the position in which it has placed itself, and when the force causing the change is removed, the needle with a seeming instinctive impulse, starts out to find its former position; swinging forward and back, and like the pigeon does not stop or tarry by the way until it finds its former abiding place.

Is there less evidence of life and instinct in the needle than in the bird?

No atom of matter that is not endowed with life, is capable of putting itself in motion, and

yet we see the needle start out and move itself as voluntarily as the movement of the human hand.

Magnetism imparts to it this *will* and *ability* to change its position, and in this respect where in do the pigeon and the needle differ?

If a winged insect and a potted plant be taken into a dark room, and a closed window be opened, the insect at once darts towards the light, and out into the open air.

By slow degrees, but with apparent design, the plant turns the face of each leaf to the light, and by steady movement *leans forward*, reaching out its arms and every twig, as if intent upon making its escape through the window into the sunlight where it was created.

Is the instinctive intelligence of living matter, less apparent in the plant than in the insect?

Can the voluntary action of either be accounted for, in a more rational way, than by supposing they result from the same *magnetic instinct* that led to the selection of iron from sand, and guides the needle in placing itself in the proper position to point in the direction of the North Star?

There seems to be a double life—a Magnetic Life, imparting motion and instinct to matter, which is subject to death and resurrection. By mechanical appliances this life can be driven out of the needle, and it is dead—it lies in helpless inactivity, incapable of pointing in a northerly direction, as the crushed and mangled sticks trodden under our feet.

By mechanical manipulations the Magnetic Life can be restored, and the needle becomes as active and intelligent as it was before the death blow was administered.

There is evidently a more advanced and perfect life—a LIFE evolved or born of ELECTRICITY that imparts intelligent motion, mind, cunning, reason and judgment to created objects; which is also subject to death but not to mechanical resurrection. When the electric spark is crushed out and gone, the living body becomes a lifeless mass, and no mechanical appliances, however skillfully manipulated, can restore it.

This life and death experiment can be repeated on the magnetic needle, with unvarying result, which shows conclusively that magnetism is subject to mechanical action and control, anp

must therefore, according to the standard adopted in chapter three, be regarded as an imponderable *fluid.*

The instinctive intelligence of magnetism, which vibrates between living beings, has attracted much attention and is called "animal magnetism."

The magnetic intelligence thus communicated, may account for some, possibly all of the mysteries surrounding the manifestations of mesmerism, clairvoyance, and the new born science of psychology.

CHAPTER XV.

COMBUSTION: THE MYSTERY OF NATURE.

Combustion has been the one mystery of a life-time. In childhood, when witnessing the operations incident to clearing land in a heavily timbered country, the sight of great logs and trees consumed, eaten up, and made to disappear in a single night, was such a source of wonder and astonishment, that even then this question presented itself: "What has become of the large piles of wood—where have they gone?"

It is probable that most people while sitting before a burning grate, and observing the gradual but steady melting away of the blocks of fuel, n perfect wonder and astonishment at their constant disappearance, ask themselves this question, "What causes this wonderful change that is going on before me?"

Unable to find a satisfactory solution to such an important question, a learned scientist, exalted

to high position as one of the educators of the rising generation, was appealed to for a satisfactory solution of the hidden mystery, and his intelligent and educating reply was, "*It is agitation!*"

To give a more satisfactory if not a more intelligent answer, is the purpose of this and the following chapter.

From the very beginning, combustion seems to have been a *paradoxical enigma* in science.

Some two hundred years ago, the first theory regarding it was formulated and published that attracted general attention, is thus described in the *Encyclopædia Britannica:* "Stahl's celebrated theory of combustion was founded upon the hypothesis of the existence of a substance which he called *Phlogistone.*

"Every combustible body was supposed to contain this substance, which was disengaged by combustion, the loss of the Phlogistone was the cause of the residuum being incombustible. The heat and light resulting from combustion were attributed to the violent agitation of the Phlogistone, at the moment of its disengagement."

This system, although receiving general approval and holding its ground for the greater part of a century, was entirely supplanted by the theory of Sir Humphrey Davy, which held "that the burning body and the supporter of combustion, were in opposite electrical conditions and that the heat and light were evolved in the discharge of their opposing electricities."

Again we find, according to a modern theory given in the *National Encyclopædia*, that the heat produced during the process of combustion, "is caused by the direct conversion of motion into heat." Thus the combustion of carbon in oxygen is said to be "due to the clashing of the atoms of carbon and oxygen, which rush together under the influence of the force of chemical affinity, with an enormous velocity, and when they come into collision their motion of translation is transmuted into that kind of vibratory motion, which we call heat."

These several theories having been introduced, in their day they held the approval and support of learned scientists and the leading minds of the age, only in the end to prove insufficient and unsatisfactory, each in its turn giving place to

the introduction of a more favored successor.

A more modern theory, which seems to have driven all of its predecessors out of the field and gained the confidence and approval of scientists of the present day, is described in the *Globe Encyclopædia*, "as the consumption of a substance, with evolution of heat and light, when it is raised to a sufficiently high temperature in air or oxygen; the phenomenon of combustion depending upon the union of the combustible body with oxygen, which causes the disengagement of light and heat."

Having thus gone over the whole field of theories regarding combustion, that have claimed the attention, and in turn met the approval of men of learning, during the last two hundred years, it is surprising to find how meager and unsatisfactory they are, compared to the importance of the subject under investigation; nor is it any wonder that a learned writer says: "It does not appear that there is at the present time any received theory that will explain all, or, in fact, any familiar phenomenon of combustion."

The subject of combustion does not at the

present time receive the attention its nature and importance demand; for even the word does not occur in modern text-books, except *incidentally*, and then not to illustrate or explain anything relating to the decay or decomposition of matter, with which it is most intimately concerned.

Those several theories having all been worn out and abandoned, except the last one quoted from the *Globe Encyclopædia*, and that having become at least "*threadbare*," it seems an opportune time to introduce something that may be accepted, and prove another step in advance, towards the proper solution of this most interesting and important subject.

CHAPTER XVI.

NEW THEORY.

A new theory regarding combustion is here introduced and stated as follows:

Combustion is one of the forces of nature, stored up and dormant in matter, but when liberated by overcoming cohesiou, so acts upon matter as to cause a change from its organic form, to its elementary condition.

When elementary matter has been united by affinity, and bound together by cohesion so as to create organic or compound bodies, cohesion is stored up in the formation and growth, and lies dormant in the matter of which all such bodies are composed; and there is no other power known to man, that can liberate it, so as to restore the matter contained in such formations to its elementary condition, but combustion.

When an organized body is decomposed by combustion, every atom of matter contained in

its composition is liberated, set free, and restored to its elementary condition, and nothing can be so liberated and set free, that did not constitute part of the body decomposed.

Take a dry leaf by its stem, ignite it, and watch the result. As the process of combustion goes on, light and heat are constantly made manifest to our senses, and the leaf will disappear, leaving nothing but the stem in the fingers.

While the leaf was burning, a little smoke and a bright blaze attracted your attention.

The *smoke* was matter contained in the leaf that had been *disintegrated* and made so light as to float in the air, but was not decomposed into elementary matter.

The *blaze* was the *visible process*, by which the heat and primary colors stored up in the leaf, were *liberated* by combustion, and *reconverted* into light and heat.

The *ashes* remaining, represent the ponderable elementary matter that gave *weight* and *form* to the leaf.

Again, take a small quantity of alcohol in an open vessel, and when ignited, it will burn with

a steady flame, until the last particle has been decomposed, leaving no perceptible trace of its previous existence.

The inquiry becomes pertinent: What has become of the leaf, and of the alcohol?

When any object disappears we know that it has not been annihilated, but that it exists in some other form or condition; thus, if a pool of water is evaporated by the sun and disappears, we know it exists as water in a state of vapor, floating in the atmosphere.

By applying the same reasoning to these experiments, we shall find that the leaf and the alcohol have not disappeared into merely vapor, or gases, but that they have been decomposed by combustion, and gone off in atoms of the elmentary matter of which they were created.

Light and heat have been constantly evolved and passed off as the process of combustion went on, and the leaf and the alcohol, which no longer exist as such, have either been annihilated, or exist as elementary matter, which has been liberated and set free.

From these experiments, it is obvious that combustion acts upon matter so as to cause a

change from its organic form, to its elementary *condition;* and the conclusion seems irresistible that light and heat were stored up and constitute a very important part of the leaf and the alcohol, which were decomposed and have disappeared.

Light cannot be stored up as light, but primary colors are stored up in great abundance in every created object; and when liberated by combustion, are converted into light, through the action of the blaze as above described.

As no visible residuum remained, it seems probable that there was no other *ponderable* elementary matter contained in the alcohol, except *water*, which was vaporized, and disappeared, as the combustion went on.

It matters not whether the process of combustion is slow, active, or instantaneous like the explosion of gunpowder; the result is always the same; light, heat, electricity, and magnetism are evolved and pass off, as the organic substances are decomposed, and any residuum that remains is simply ponderable elementary matter that cannot be decomposed by combustion, or by any other known process.

Combustion thus becomes not only the great

destructive force, but the great *equalizing* force of nature, which, by constantly reducing organic bodies, preserves the necessary equilibrium between organic and inorganic matter, else all matter would become organic, and the source of elementary supply would fail, and animal and vegetable life could make no further progress.

The natural forces recognized by science, may properly be called creative forces, because all manifest their presence and unceasing energy, in the growth and maintenance of the animal and vegetable kingdoms.

Science finds no difficulty in determining that all this building up is the work of natural forces; but when it comes to the more speedy and powerful work of pulling down, taking apart, and destroying in a few minutes, that which the other forces have been ages in bringing together and building up, all is at sea; it is not admitted to be the work of a natural force, but simply some "chemical change," a *uniting* of something with something else!

The idea that combustion is a *condensing*, and not a *decomposing* process, seems too absurd to have ever claimed the attention of

reasoning minds and comprehensive understandings.

Combustion, like other forces, is stored up and lies dormant in matter; and it is only when liberated that it becomes active, and proceeds to the work assigned it by the Creator of the Universe, that of decomposing and bringing matter back from its *organic* form, to its *elementary* condition; and in performing this work its action is mechanical, and its effect chemical.

CHAPTER XVII.

PRIMARY COLORS.

Natural philosophy, like most other things that we have to deal with, has its two sides, *theoretical* and *practical.*

It has been well said, that "*theories are guesses at truth, but that experiments prove the truth or the falsity of the guess.*"

Theories are the children of genius and imagination, while experiments are the work of reason and judgment, in the application of mechanical and vital forces, to the various conditions of matter, and ascertaining results, from careful observation of the effects produced.

The theoretical side rests upon assumption, without experimental support, and often without the slightest reason or common sense to aid or sustain the theory advanced.

Notably the theory of a universal ether, is of this character, for by no possible experiments

made by the most astute scientist, can its presence be detected; and yet wise men compute its vibrations, and determine with mathematical certainty the exact number necessary to cause each color composing light, with the same dogmatic assurance, that they determine the square inches contained in a block of wood, or the number of grains in a pound.

In text books of physical science, a table of vibrations is given, showing the exact length of each vibration, and the precise number occurring in a second of time, that are required to produce each of the different colors found in the rainbow.

In these tables it is stated that the variation ranges all the way from 39,180 to the inch in length, and numbering 458 trillions in a second of time, which will make visible the color of red, to 57,490 to the inch, and 675 trillions in the second to produce violet, at the foot of the list.

Six hundred and seventy-five trillions of vibrations in a second, is a large number, and it is to be hoped there is no mistake in these computations, as the slightest error must necessarily produce a different shade of color.

When two or more colors blend, they create

or cause a new color, or a different shade of color, so that the number of colors may be as great as the number of vibrations in a second required to produce one color, and yet every different shade of color must be produced by a different number of these vibrations.

But the wave theory does not rest here, but sets up another peculiar claim regarding colors, which needs attention. It is this; that colors are reflected so as to make objects appear to be of a color they themselves do not possess.

For example, the leaf of a tree or plant is said to "absorb all of the other colors, or *kill down* the vibrations that cause them, and reflect the green;" so that we see a green leaf, that has no green in it, while objects that do not reflec any color it is said "will appear black."

The experiment relied upon to prove this theory given in text-books, is as follows:

"Fill a spirit lamp with alcohol in which a large quantity of salt has been disolved; on being lit it will be found to burn with a livid yellow flame. Let a room be lighted entirely by one or two such lamps. It should if possible be hung with pictures in water and oil colors,

and the persons present ought to wear nothing but the brightest colors, and the table be ornamented with the gayest flowers. Let the lamps be brought into this darkened room, and an astonishing appearance will be presented. The furniture and every other object which the room contains, will reflect but a single color. The brightest purple, the purest lilac, the liveliest green will be converted into a monotonous yellow. The same changes will take place in the countenances of those present; every one will laugh at the appearance of his neighbor's face without thinking that he is just as great a subject of laughter to them.

"Nothing can better than this experiment show that bodies will seem to be of the color which they can reflect. When they receive only yellow rays, they can themselves be of no other color."

In this experiment the learned author has evidently arrived at his conclusion, "that bodies will seem to be of the colors which they can reflect," before pursuing the investigation far enough to determine whether any objects have the power of reflecting their colors, any more than they can reflect their size and shape.

In order to prosecute this investigation farther, in a convenient vessel, prepare a mixture of Nitrate of strontium, chlorate of potash, lycopodium, and shelac, (which any druggist will prepare for a few cents) and when lighted it will burn with a brilliant red flame, and every thing in the same room which was before so yellow, will now all appear to be a bright uniform red.

To make this experiment still more interesting and complete, requires two dark rooms connected by a door.

Open the door two or three inches and cover the opening with green leaves and flowers.

This done, burn in one room the red light, and in the other the yellow light at the same time, and the leaves and flowers covering the opening will appear to be bright red on one side, and pale yellow on the other to persons in the different rooms.

Now suppose we take a yard of calico, having half a dozen or more bright colors, and fasten it on the door so that when the door is closed, one half will be seen in one room, and the other half in the other room.

Now if we burn the yellow light in one room

as before, and light the other room with an electric light, the result will be, that while in one room every color of the calico will be as distinct and brilliant as if seen by daylight, in the other room the same calico will appear to be a plain yellow cloth.

From these experiments the conclusion seems to be inevitable, that the leaves, the flowers and the calico, *do not reflect* THEIR COLORS, *but only the light that falls upon them.*

If the leaf is endowed with the capacity to reflect its green, and the rose its red color, in what way, or by what process is their nature suddenly changed, so that they can both reflect only a uniform yellow or red?

If the yard of calico retains its property of reflecting all its brilliant colors in one room, what has changed the nature of the other half of the same cloth so that it reflects but a single color, yellow?

The red and the yellow lights, being reflected back to the eye from the objects they fell upon, made them all appear of one color, *the color of the light they reflected.*

The electric light, having no colors of its own,

when reflected to the eye, enabled us to see and determine the *colors* of the objects reflecting it, with the same degree of certainty, that we see and determine their *size* and *shape*.

CHAPTER XVIII.

NEW THEORY REGARDING COLORS.

The seven primary colors, are seven distinct kinds of imponderable elementary matter, which uniting with other matter create new matter, and are thus stored up in the formation and growth of all combustible bodies; and again become LIGHT, *when liberated and set free by combustion.*

As heretofore stated, elementary matter is of two distinct kinds, ponderable and imponderable. Some authors of scientific works, seem heretofore to have exercised their ingenuity to find appropriate terms to describe certain things or condition of things, they find to exist; one calling them "conditions of matter but not matter itself," while another says they are "immaterial substances;" but they seem to me to be much more appropriately described, as *imponderable matter.*

If light, heat, electricity, magnetism and colors, are conditions of matter, they must, I contend, be matter itself; for I am unable to comprehend any condition of matter, that is not *matter;* and as for "immaterial substances," the name given evidently resulted from an earnest effort to discover some name or phrase, that would correctly describe a class of substances that the author had found occupying space, but had no weight so far as ascertained.

The great underlying principle of creation, that "union of different kinds of matter creates new matter," does not extend so far, nor can human intelligence comprehend, how that which is not matter, *can unite*, and by such *union* create *new matter*, or something that did not before exist, as colors create light.

Colors having no weight, cannot unite so as to create anything having weight, and therefore cannot add to the weight of any substance with which they become incorporated.

The seven primary colors may be regarded as the *imponderable building material* of the universe. They are inert, and constitute all there is of *imponderable elementary matter* that is

changed in form or condition, by uniting with other matter, in the formation and growth of organic bodies, and thus become a very conspicuous and important part, giving character to every created object.

They are stored up in great quantities in certain plants, trees, and minerals, from which they are extracted in the form of dyes and paints, and thus become useful and valuable articles of commerce, as any other part of the commodities, in which they are so abundantly found.

Heat and magnetism, are subtle fluids, that come and go of their own self-acting energy, and are never like colors changed in form or condition, when coming in contact, or uniting with other matter.

A ray of light when created, undoubtedly impelled by heat, instantly starts out and travels with inconceivable velocity commissioned with its *little package of paint*, to illuminate and beautify created objects.

When the subject is properly investigated, it will doubtless be found that primary colors are not only matter, but that they constitute an important part of every explosive substance.

CHAPTER XIX.

CHEMISTRY.

Chemistry treats of the composition of substances, and the changes they undergo.

Elementary matter is incapable of undergoing any change from any cause whatever, except such as is found to take place, by a union of different kinds of matter, in the creation of organic or compound bodies, and their subsequent decomposition by combustion, and restoration to an elementary condition.

It will be apparent then that combustion marks the dividing line between elementary and organic matter, as before stated, so plainly that it cannot be mistaken.

The experiment of burning a combustible substance in a closed jar of oxygen, demonstrates the fact that the oxygen is changed in form and condition by the burning, as well as is the substance burned with it.

Inasmuch as elementary matter cannot be burned or decomposed, it must of necessity occur that the oxygen is combustible matter, and that the ponderable constituent part of its organization will be found in the jar, united with the ponderable, elementary portion of the substance that was burned and decomposed with it.

When combustible substances are burned in a closed jar of oxygen, two important conditions become so apparent, as not to escape the notice of the most casual observer, viz: the *decrease in volume*, and the *preservation of weight.*

The first definition given, or principle established by text-books of physics, is this: "Matter is anything that occupies space, or takes up room;" and yet every chemist ignores this well-established principle of physics, and asserts that "there is no other evidence of the existence of matter but *weight*," and that "oxygen has simply been *condensed* by combustion, and united with the other substance burned, which has caused the vacuum found in the jar."

We shall see hereafter whether this diagnosis of the case is correct, and the best one that can be made.

CHAPTER XX.

CREATION AND DECOMPOSITION OF WATER.

Chemistry teaches us that water is created by the union of hydrogen and oxygen gases, and that it can again be decomposed, and reconverted into those two gases.

It is my purpose in this chaper, to show beyond any reasonable doubt:

First.—That this supposed creation and decomposition of water are *theoretical illusions* and do not take place.

Second.—That water is *elementary matter* and therefore cannot be decomposed; and,

Third.—That hydrogen and oxygen gases, are *compound combustible substances*, and not the component parts of water.

The decomposition of water, by which it is supposed to be converted into hydrogen and oxygen gases, mentioned in text-books, and

particularly described in Dr. Cooley's *Natural Philosophy* page 171, is made by the galvanic battery, as is here illustrated by Fig. 1.

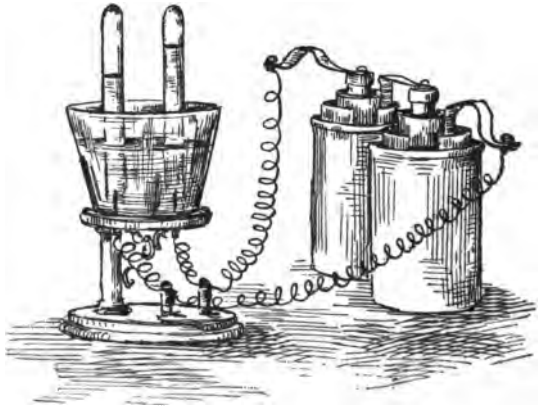

FIG. 1.

The process is this: the two wires or poles of an electric battery are inserted through the bottom of a vessel, into the water contained therein.

Over each wire or pole of the battery, is placed the open end of a glass tube filled with water.

The author then says: "We need only put the poles of a strong battery into water, and bubbles of gas will rapidly rise from both. The water is changed into two gases. We see the

wires from the battery go up into a vessel of water, and that two tall tubes are placed over them.

"These tubes are there to catch the little bubbles of gas, into which the water is changed. They were filled with water at the beginning of the experiment, but as the bubbles rise they drive out the water. One tube is filled twice as fast as the other. One of these gases is hydrogen, and the other is oxygen, and the hydrogen is given off the most rapidly.

"The electricity in this case helps us to learn that water is made up of two very light colorless gases, hydrogen and oxygen, and that it contains twice as much of the first as of the second."

In this experiment, both poles of the battery are inserted into the same vessel of water, with a receiving tube over each; and being some inches apart, it seems strange and out of the natural course of things that as the water is supposed to be decomposed into two gases, all of the hydrogen should go up and be found in the tube covering the negative pole, and the oxygen should go up and be found in the tube placed over the positive pole of the battery.

A professional chemist being requested to explain this remarkable phenomenon, replied: "As the current of electricity passes through the water from the negative to the positive pole, each molecule of water is decomposed into two atoms of hydrogen, and one of oxygen, and the hydrogen is attracted to the negative, and the oxygen to the positive pole of the battery. This is the theory, and it is all we know about it."

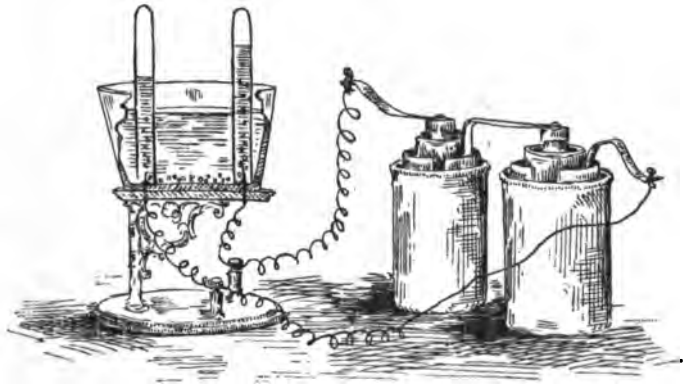

FIG. 2.

In this way it is explained, that each kind of gas is found pure and simple, in the separate tubes covering the two poles of the battery, as shown by Fig. 2.

If this explanation of the process were true, it

would be conclusive evidence that the water was decomposed into these two gases.

Since, however, this theory, that the little bubbles of gas are attracted and travel laterally through the water from each pole of the battery to the other, seems to be so improbable, if not impossible, that it cannot be entertained.

The most important result of teaching this theory has been to stifle proper investigation, and lead the student to acquiesce in a false theory without carefully inquiring into its merits.

This explanation must therefore be rejected, and the conclusion adopted, that water is not *decomposed* but that the gases are *generated* at the poles of the battery where they are found.

To make the creation and composition of these two gases more clearly and correctly understood, and to show conclusively that they do not come from the decomposition of water, required the invention of an apparatus for making another experiment, which is here illustrated by Fig. 3.

In this experiment the tubes are placed in two separate vessels of water instead of both in one, as was the case in the experiment previously given and represented by Fig. 1, which has been

the standard illustration of all text-books, up to the present time, upon this subject.

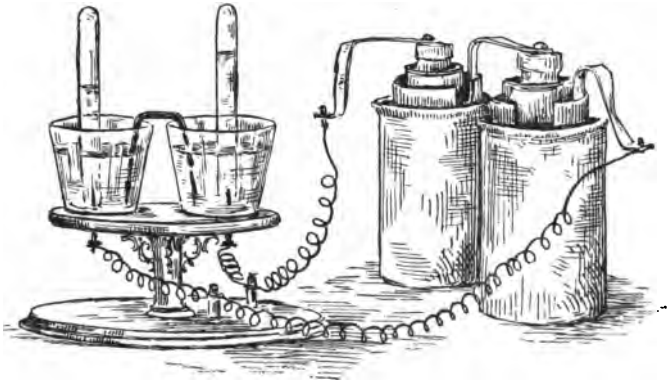

FIG. 3.

The water in the two vessels is then connected by a carbon bridge, over the sides of the vessels, made in the shape of an inverted letter U. This carbon bridge completes the electric current and causes the process of making hydrogen and oxygen gases to go on without the possibility of the different gases being attracted and traveling from one pole of the battery to the other, as has been believed to be the case for more than a hundred years.

By prosecuting this investigation a little further, it will be found that any good conductor

of electricity will serve the purpose as well as the carbon, in making gases from separate vessels of water, and no bubble of gas will make its apparance *in*, or escape *from*, either vessel, except what will be found in the tubes covering the poles of the battery.

By this process, a definite quantity of water in each vessel can be converted into one kind of gas, the *weight* of each gas corresponding to the *decrease in weight* of the water contained in the vessel from which it was made.

Thus it is demonstrated that a grain of water can be made into an equal weight of oxygen gas, just as readily as an ounce of water can be converted into an ounce of steam.

This seems to be conclusive evidence that these gases are made by the *evaporation*, and not by the *decomposition* of water.

If switches be introduced between the poles of the battery properly arranged, another gas can be made at the same time, from a third vessel of water, differing from both the others in weight, and character.

This gas is explosive, and undoubtedly the same that is generated as the electric currents

pass through, or meet, in the clouds at intervals during a thunder storm.

That we may better understand the process by which these gases are made, the introduction of another experiment will be of great service in helping us to a correct conclusion regarding this interesting and important subject.

In this experiment both poles of the battery are introduced under one tube, as shown in Fig. 4.

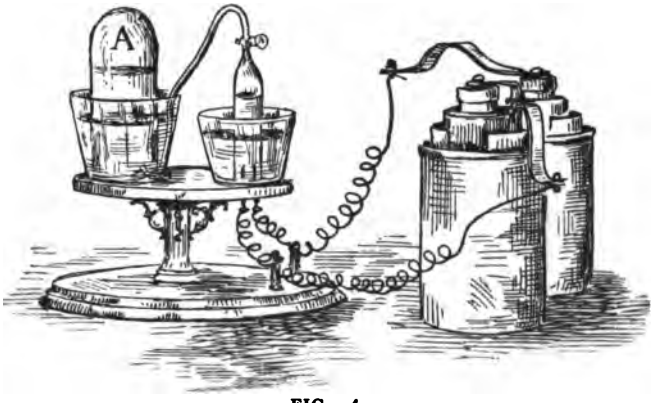

FIG. 4.

We have here both poles of the battery, supposed to be decomposing water under the same tube, and the gases, or the supposed *two parts of water*, travel together through a flexible tube to the receiver, A., which has been filled with

water, and pass up through the water, forcing it out and occupying the space thus made vacant within it.

If Hydrogen and Oxygen are the two component parts of water, or the two elements that unite to create it, what has separated them and what holds them apart, while traveling from the poles of the battery to the place they occupy in the receiver, without again becoming water?

Human ingenuity has not been able to unite these two gases, so that they will become water, except by *liberating* the electricity which holds them apart, so as to prevent such union.

When heat is introduced into water, by its subtle energy it forces itself between the particles, pushing or driving them apart, so as to create a new condition of the water, which becomes invisible, and is called steam.

When the heat and the water are again separated, each returns to its former condition of water and heat.

Any two or more kinds of matter, that will unite or mix so as to create new matter, or a new condition of matter, cannot be separated and kept apart after the cause of the separation is removed

If brass be decomposed, the copper and zinc cannot be made to travel together in a fluid state, without uniting so as again to become brass.

If air be separated into oxygen and nitrogen gases, these two gases can not be made to travel together through tubes and vessels of water, without uniting so as again to become air.

If we apply this evidence and reasoning to the hydrogen and the oxygen, it will become apparent to the most superficial observer, that if there is nothing in the receiver but the *two elements* that united to create the water, *that the electricity was supposed to decompose*, they could not have thus traveled together and remained apart as they have done; any more than the nitrogen and the oxygen in proper proportions could travel together without becoming air, or the copper and zinc of decomposed brass could flow together and not again become united as brass.

Any kinds of matter that will unite or mix so as to create a new condition of matter, cannot be prevented from so uniting or mixing, when brought together in proper proportions, except by the introduction, or interference of something of a foreign or repulsive nature to prevent it,

which must be removed before such union can take place.

It is evident that in making steam, the water is not decomposed, but that its particles or atoms are expanded and held apart by heat, so as to create the vapor we call steam, which cannot be again reduced to water except by dispersion of the heat, sufficient to remove the cause of the separation.

When this takes place, the water resumes its normal condition, and the heat equalizes itself elsewhere as it did before the necessary accumulation took place, that converted the water into steam.

In Fig. 4, it will be seen that both poles of the battery have been inserted under one tube, and that both the hydrogen and the oxygen are generated at the same time, and travel together until finally confined in the receiver.

Here we have the two supposed component parts of water, occupying the space made vacant in the receiver, in the *exact proportions* in which they unite to *create water*, as claimed by chemists, without so uniting, as they must have done, had they not been kept apart and prevented by the presence of something else.

In the case of these gases, it is just as evident that it is *electricity* that interferes and prevents them from *reuniting*, as it is the heat that prevents the condensation of steam into water.

By the process of making these two gases from separate vessels of water, as illustrated by Fig. 3, the evidence becomes very convincing if not conclusive, that these gases have not been produced by the *decomposition of water as described in text-books and illustrated by Fig. 2:* and that the two atoms of hydrogen and one of oxygen, are not *attracted*, so as to *travel laterally* from one pole of the battery to the other, as the molecules of the water are decomposed; because there is *no channel* through which they could move, as contemplated by the theory, and as has been supposed to have taken place in the experiments heretofore made: and it must be equally conclusive that the two gases are *generated* at the poles of the battery where they are found.

If then the water has not been decomposed, what has caused the generation of the two different gases, that are now found in the receiver, mingled together, but not united, and

forming one of the most powerful explosives that has yet been discovered.

Making gases from water by electricity, is one of the *natural* processes by which electric *force* is stored up in matter.

When heat and water unite and make steam, it is one process of storing up *force* in water.

When electricity and water so unite as to create gases, these gases are simply nature's *storage batteries*, in which great electric force is stored up in small quantities of matter, which can be retained or liberated at pleasure.

It is hardly possible that human ingenuity can concentrate an equal amount of *explosive energy* in the same weight of matter, as will be found in a cubic inch of these supposed component parts of water, as now mixed in the receiver.

It must be remembered that electricity is not a single elementary force, like heat, but that it is a compound intensified force, carrying *light, heat, and magnetism;* and that when it leaves the negative pole, and passes from a denser to a rarer medium, by its action upon the water, it seems probable that the more volatile portions of the electricity pick up, separate, and hold

apart the atoms of water in such an attenuated condition as to generate the lighter *hydrogen gas.*

In parting with some of its component parts in this way, when the current reaches and enters the positive pole, it is changed in composition and the character of its action; a grosser and heavier substance is generated, which has been called *oxygen gas.*

Water constitutes the *ponderable* part of these two gases, which is held apart in different degrees of expansion by the two grades of electricity that acted upon the water; the oxygen containing a greater quantity of water to the cubic inch, than the hydrogen, the exact difference corresponding with the difference in the weight of the two gases.

These gases may very properly be called *electric steqm,* since they are created by electricity acting upon water, in a manner analagous to the process of converting water into steam by heat.

Heat is a simple, subtle fluid, that always acts upon water so as to transform it into the one uniform condition of steam, and the water and the heat are readily separated by rediation·

Electricity being a compound fluid, so acts upon or combines with water as to generate *two* qualities of *electric steam;* and when united and confined, as in the receiver, the electricity and the water can be separated by *explosion.*

When the electric spark is applied and the explosion takes place, the gaseous contents of the jar are instantly *expanded* with a violent shock, requiring more room than they did as gases; yet it is asserted by chemists, that "the explosion simply *condenses* the hydrogen and the oxygen into a very small quantity of *water.*"

It is not possible that water can be created in this way; as well might it be claimed that the explosion of gunpowder condenses carbon into diamonds.

The explosion demonstrates the fact that the gases contained in the receiver were composed of something that required *expansion,* before *contraction* could take place.

When oxygen gas is so generated that it unites with something else, as it does with nitrogen in the creation of air, it seems to acquire a fixed condition, and so remains until liberated by some less violent form of combustion.

When oxygen gas is generated so that it does not come in contact with anything with which it can unite, the *electricity* and the *water* in the gases, are as readily and quickly separated, as heat and water are separated in steam.

When a jet of steam is passed through a glass tube, it is invisible; but when it strikes the atmosphere the heat radiates, so that the water contained in the steam condenses and becomes visible.

If the tube covering the positive pole of the battery, as shown in Fig. 1, be removed, and the electrode so arranged that the "little bubbles of oxygen" will pass up through the water in one channel, when they reach the surface and strike the air, condensation or separation takes place, the *electricity is liberated*, and the water contained in the oxygen condenses so that in a strong light, with a powerful magnifier, it becomes visible, as *tiny waves of vapor* on the surface of the water.

I have observed this phenomenon too frequently to be mistaken as to the fact here stated.

The discovery that both hydrogen and oxygen gases can be condensed to ice by freezing, adds

an important link in the chain of evidence, that water constitutes the ponderable part of both these gases.

To demonstrate this discovery, let any one take a small mirror or a plate of polished metal, expose it to intense cold, and throw upon it a jet of either hydrogen or oxygen, by means of a gas bag, and watch the crystals of frost as they gather upon its surface, and their subsequent conversion into water, when the temperature is again sufficiently raised.

Nitrogen gas is as transparent, tasteless, and odorless as hydrogen and oxygen, and it is probable that its component parts are electricity and water, combined in different proportions than in the other two gases.

It seems to be not only possible, but quite probable, that every gas known to science is largely composed of *electricity* and water.

The conversion of water into steam, has been called the evaporation of water by heat; and the generation of hydrogen and oxygen gases will be much more correctly described by calling it the evaporation of water by electricity, than by calling it the decomposition of water.

It is this combination of electricity and water, that does the *magical work*, for which an *imaginary* substance called oxygen gets the credit.

All gases are undoubtedly compound, and such a substance as simple elementary gas, will hardly be found to exist in nature.

Combustion is stored up in oxygen gas, in greater abundance than in any other known substance—hence it may very properly be called *nature's kindling wood*, since nothing burns without it.

From the knowledge gained by these experiments, the inference is irresistible that electric force is *stored up* when making these gases, as heat force is *stored* up when making steam.

When the heat is dispersed by radiation, the steam condenses into water. In like manner when the electricity is set free by combustion, the water contained in the hydrogen and the oxygen gases, *condenses* and becomes visible.

Hence the conclusion that water is *the element*, and that it is not created by the union of two *combustible gases*.

CHAPTER XXI.

ELEMENTARY WATER.

That water is an elementary and not a compound substance, seems probable from the fact that it can not be burned or decomposed by combustion; but on the contrary that it "kills down" combustion, in its most active and violent attacks upon combustible substances.

Combustion decomposes, separates, and expands the different kinds of material, composing every compound substance that will burn; and yet chemists tell us that hydrogen and oxygen gases are not decomposed, but that they are *condensed* into water as combustion acts upon them.

Can greater inconsistency be *condensed* and expressed in so few words?

That water is simple matter, would seem probable from is great abundance in a free state,

and the important duty it performs in carrying on the work of creation.

No created living object can come into being, or exist without it.

Scientists will undoubtedly agree that organic or compound substances do not enter into the formation and growth of plants and trees, but that elementary matter, only unites in the creation of new vegetable matter, and in this way water adds to, and promotes the growth of every thing found in the vegetable kingdom.

Not only that, but it holds in solution, and carries up into every plant and tree, every atom of *ponderable matter* found in the wood and fibre composing the different parts thereof.

Water and the *ponderable* elementary matter held in solution, and carried up by it into growing vegetation, uniting with the *imponderable* matter furnished by light, heat, and magnetism, creates new matter, and in this way all of the different kinds of vegetable organizations are created.

If water was an *organic* or compound substance, created by the union of two of the most *inflammable* and *explosive* substances known to

man, it would not be likely to thus unite with other elementary matter, so as to create new matter, because compound substances only mix, and create conglomerates and other compounds.

Ponderable elementary matter is wholly non-compressible. Its atoms, as created, *fill the least possible space*, they can ever be made to occupy.

That water is elementary, seems probable from the fact that it is wholly non-compressible, admitting of no condensation save what results from the compressibility of foreign matter contained within it.

The compressibility of water may depend largely upon heat, since it is said to admit of greater condensation at 200, than at 40 degrees of temperature.

Every known compound substance is compressible, and its degree of condensation is gauged by the proportion of ponderable to imponderable matter contained in its composition to the cubic inch, which can always be determined by weight.

It therefore seems quite conclusive that water is elementary, and not a compound sub-

stance created by the union of hydrogen and oxygen gases, brought about by the most violent of all forms of combustion, *explosion.*

It is hardly reasonable to suppose, that in carrying on the work of creation, nature in her frugal economy, would resort to the round-about way of condensing TWO *combustible gases*, to create ONE *non-combustible* water.

CHAPTER XXII.

COMBUSTIBLE GASES.

Hydrogen and oxygen gases are essentially different substances; one burns readily in the open air, while the other will not burn except in connection with something else, that will burn with it.

If a jar be filled with oxygen gas, and a strip of iron or steel, like the spring of a watch, with a trifle of burning sulphur attached to its end, be introduced into the jar, it will instantly flash up and burn with a light, brilliant and white as sunlight, and so continue as long as the supply of both holds out.

While the combustion was going on, the electricity was being liberated from the gas contained in the oxygen, and at the same time the elementary water was being united with the elementary iron, so that what remained in the jar after the burning, was a new compound,

called *oxide of iron*, which will equal in weight the gas and the iron that have been burned; while the volume of light, heat, electricity and magnetism that have been evolved with great brilliancy and made their escape as the burning went on, have left in the jar a vacuum, except by so much as the trifling space occupied by the remaining oxide of iron.

By a subsequent process, the *water* can be *extracted* from this oxide of iron by *electricity*, and its weight will be reduced by as much as the weight of the oxygen gas that was consumed in the burning, leaving a residuum presumably of pure iron.

This residuum may be regarded simply iron ore, which can be melted and again manufactured into one of our most valuable articles of commerce.

This single experiment illustrates in a very clear and forcible manner, the process of *combining* and *separating* different kinds of elementary matter, as well as the liberation of *force* from matter.

The burning of but a small quantity of iron in pure oxygen gas, liberates a sufficient amount

of *electric force* to propel light machinery if properly applied, which may soon be done with but slight improvement in storage batteries already in use.

Notwithstanding all this has been going on, and a force generated sufficient to move street cars in their presence, chemists very gravely inform us that "nothing has taken place in the jar, but the *condensation* of the oxygen so as to form a union with the *iron*," which they claim constitutes the *sum total of combustion;* and that it is this *condensation* of the oxygen and not the escape of anything occupying space that has left the jar, that caused the *vacuum* within it.

The burning of the iron in the jar was evidently a decomposing and not a condensing process.

The watch spring, which was steel in one of its most refined conditions, being compound matter, was gradually eaten into, taken apart atom by atom, and reduced to its elementary condition of iron; while the great volume of light, heat, electricity, and magnetism, that had been stored up in the material burned, was also

liberated little by little as the combustion went on and made its escape, thus enabling the elementary water and the iron to unite and form a new compound, as before described.

Formation and growth *condense* matter, combustion *expands* it.

Elementary matter is not combustible. If hydrogen and oxygen gases were simple elements, they would neither burn, nor could they be exploded; because only compound substances are combustible or explosive

This may be regarded as an immutable law of nature.

Hence the conclusion that hydrogen and oxygen gases are *compound combustible substances*, and not the component parts of water.

CHAPTER XXIII.

THE WAVE THEORY.

The *imponderable vibrating ether*, of which we hear so much, and know so little, being matter capable of vibration, must of necessity be subject to the laws governing vibratory matter.

The *first* objection to this vibratory theory regarding light, heat, electricity, and the seven primary colors, lies in the fact that the *ether* is not known to exist, except as the creation of a subtle imagination.

When asked for some evidence of the existence of this wonderful ether, so prolific with vibrations, the *Learned Theorist*, will gravely reply in this way: "When you see the tracks of a horse, you know that there must have been a horse there that made them. We see the tracks of the ether in the vibrations that give us light, heat and colors, and hence we know that the

ether must exist, although the animal itself is so well concealed as not yet to have been discovered."

Very well, this seems to be fair and plausible reasoning, but suppose instead of seeing the tracks of a horse, you see a great number of different kinds of *tracks*, the natural conclusion is, that there must have been as many different kinds of animals to make them, although you have not seen and cannot find the animals that made the tracks; would any sane man hazard his reputation by insisting that the different kinds of tracks, had all been made by one animal?

The most learned and astute scientists will tell us and would have us believe, that not only light, heat, electricity, magnetism and the seven primary colors, but the myriad different shades of color, are all tracks of this one animal, *vibrating ether.*

The *second* objection to the ether theory lies in the fact, that every action, every movement in nature, is governed by fixed and unchangeable laws; and that with the production of sound, *the law of vibration is fulfilled.* There is no other duty in the economy of nature that vibration can perform.

Nature never produces *two primary results*, from the same cause. Whether vibrations are long, slow and heavy; or short, sharp and quick, from every known material in the universe, the result is always the same; the sensation of sound, and sound only.

The *third* objection is, that the *vibratory tracks* of this ether, are altogether too numerous, and too multifarious in results to accord with the harmony of nature, or be more substantial than the vision of a passing dream.

Professor Sidney A. Norton in his work entitled, "Elements of Physics," and other text books of science, tells us that 39,180 vibrations in length to the inch, and 458 trillions in a second of time, will produce or cause the color of red; and that 57,490 vibrations to the inch, and 675 trillions in a second will produce the color of violet, the liveliest skipper of them all; sandwiched in with the necessary variations to produce the different colors of the rainbow; with all these myriads of vibrations combined, to produce light to the eye, and still other changes to give heat to the nerves, and electricity for mechanical purposes.

Such a medley of vibrations in a single moment of time, might well produce the Siren's song of enchanting melody, and bring their mission to a close. But no, their work is not ended —their task but half performed. These vibrations, so prolific of conception, and so pregnant with results, must *paint* the rose, *boil* the pot, *light* our streets, and *ring* the door bell. There is no end to the miracles these mysterious vibrations can perform.

If upon a score of musical instruments in close proximity, different tunes were played on each at the same time, what ear could separate and analyze the sensations, so as to distinguish one tune from another, or even a single note of any tune, distinct by itself?

Must not the same confusion result in relation to colors, from the multitude of different vibrations entering the eye at the same time? Yet we may enter a flower garden where there are not only a score, but an hundred score of colors, and differing shades of color, all created by different velocities of vibrations entering the eye at the same instant of time; and yet every color, and shade of color will be as distinctly discernible as if no other color was present.

Science consists of self-evident and acknowledged truths; but it is neither a self-evident nor an acknowledged truth, that ethereal vibrations to the number of 458 trillions in a second, will make visible the color called *red*, as mathematically demonstrated by the learned professor above quoted.

Professor Josiah P. Cooke, Jr., of Harvard University, informs us in his work entitled "*The New Chemistry*," that it requires 477 trillions of vibrations in a second, to give us the red color, and that a correspondingly greater number will be requisite to produce each of the remaining primary colors.

An ascertained difference of nineteen trillions in a second, would seem to be quite sufficient to create a different color; and under dinary or circumstances would be taken into account, in ascertaining correct results.

Deschanel a French philosopher, in his *Natural Philosophy*, says that "Four hundred millions of millions, vibrations in a second, will give us the color of red."

Here is a still greater difference, and yet in science where mathematical accuracy above all

things else is relied upon to establish truths, these trifling discrepancies in the matter of *mixing colors*, have never attracted attention, or been taken into account.

To compute, however, with mathematical precision, such stupendous arrays of vibrations of an *unknown substance* might well challenge the acumen of that literary genius, said to be "so thoroughly educated that he could discover a fly on a barn door, but could not see the door."

The *fourth* objection is,—that only the vibrations, the tracks of this ethereal animal,—and not the animal itself have been discovered.

Dr. Thomas A. Edison in discussing this subject, says:—"As to this ether that speculative scientists suppose to exist, I do not know anything about it. Nobody has discovered anything of the kind. In order to make their theory hold together, they have, it seems to me, created the ether. The ether imagined by them is unthinkable to me. They say it is as rigid as steel, and as soft as butter, but my mind is unable to grasp the theory."

An adverse opinion from such authority—from a man who deals with electricity, one of the

supposed creations of vibrating ether, as no man has dealt with it before—might well be regarded as a staggering blow, if not a death wound to the whole wave theory.

The *fifth* objection is, that every manifestation supposed to result from the vibrations of ether, can be made subject to mechanical action and control.

It is hardly possible, that any man can be found in the last decade of the Nineteenth Century, whose intellect is so *enmeshed* with this net work of ethereal vibrations, as to contend for one moment that machinery can act upon, or in any manner control, that which is not material.

The *sixth*, and a very formidable objection to the theory is found in the fact, that if the supposed ether has any existence, it exists as matter, since nothing but matter can vibrate; and being matter however ethereal, will of necessity resist the movement of all bodies passing through it.

Therefore if the planets were flying through infinite space, filled with a material which scientists tell us is "rigid as steel and soft as but-

ter"; they must be subject to a steady resistance which however slight, would be sufficient to retard their progress, so that like an object shot or thrown through the air, they would in time be brought to a stand-still.

The *seventh* objection is, that it *presupposes* the work of creation to have been commenced with the making of this ether.

If this was not the case, then there must have been a period, when the world was without light, heat, electricity, magnetism, or colors; and must have so remanied, until convenience or necessity caused the Creator to construct an *ethereal vibrating machine*, with which to manufacture the most important and powerful of all of the forces of the universe, as well also, as the seven primary colors with which to ornament and beautify created objects.

Nature exhibits her beautiful colors in the rainbow; her powerful electricity in the storm clouds; her intelligent magnetism in the placid lode-stone; and her invigorating heat everywhere.

Speculative scientists tell us that these are secondary creations—after thoughts—mere sen-

sations resulting from vibrations of an ether so intensely ethereal, that astute chemists have been unable to detect its presence.

To absorb such a belief, cramps and belittles the intelligence of man, and degrades the wisdom and power of God.

I am aware that this is "sowing good seed on stony ground," but there is a generation coming when perchance it may "spring up and bear fruit, yielding fifty or an hundred fold."

The wave theory of Christian Huygens, may have been well enough in his day, when thunder-storms were regarded as "earthquakes in the sky," and the foremost minds of the age had no knowledge of the unlimited power of *heat*, that can be obtained through the agency of steam for mechanical purposes. Neither had scientists the slightest conception of the *magical power, and lamb-like docility*, of the lightning of heaven, when captured and tamed by human skill; made to carry our messages, and serve as a substitute to relieve the patient, jaded beasts, from the servile duty of drawing street cars.

When scientists of the future shall deal with *imponderable matter as they find it*, and not

waste their precious time computing the velocity of vibrations that have no existence, except as the creation of a subtle imagination, then it may so be that the science of physics will make as great strides forward, as did the science of astronomy, when it became known that the earth was not a *flat stationary body*, around which the sun and moon made their orbits daily, save in the one instance when at the command of Joshua, "the Sun stood still upon Gibeon, and the moon delayed to rise upon Aijalon."

THE END

OCT 2

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